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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/705,579

11/10/2003

Sridhar K. Kailasam

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EXAMINER

RODGERS, COLLEEN E

ART UNIT

PAPER NUMBER

2813

MAIL DATE

DELIVERY MODE

08/21/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/705,579	Applicant(s) KAILASAM ET AL.	
	Examiner Colleen E. Rodgers	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 6, 8-14 and 28-62 is/are pending in the application.
- 4a) Of the above claim(s) 29-54 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 28 and 55-62 is/are allowed.
- 6) ☒ Claim(s) 1-3, 6 and 8-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 20 June 2007 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 11 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, claim 11 contains a limitation requiring the protective layer to be formed of copper to a thickness of less than 20 angstroms. This layer is required by its dependency from claim 1 to be removed prior to the electrochemical deposition of copper over the surface. According to the instant specification, however, when the protective layer is formed of copper, it is **not** removed according to the instant invention. Rather, it functions as a seed layer for the deposition of copper thereover [see paragraph 0022 of the instant specification].

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-3, 6, 10 and 12-14 are rejected under 35 U.S.C. 102(e) as being anticipated by

Dubin et al (USPN 7,060,617).

Regarding claim 1, **Dubin et al** disclose a method for depositing copper overlying a work piece, the method comprising steps of:

depositing overlying the work piece **200** a barrier layer **210** having a surface;

forming a protective layer **222** that overlies said surface of said barrier layer and that inhibits oxidation of said surface;

removing the protective layer [see col. 4, lines 31-54]; and

after removing said protective layer, electrochemically depositing copper **230** overlying said barrier layer.

Regarding claim 2, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of electrochemically depositing comprises depositing by electroplating [see col. 4, line 62 to col. 5, line 7].

Regarding claim 3, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of depositing overlying a work piece a barrier layer comprises depositing overlying the work

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piece a layer of material selected from the group comprising ruthenium or cobalt [see col. 3, lines 27-30].

Regarding claim 6, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of forming a protective layer comprises forming a protective layer having a thickness no greater than about 20 angstroms [see col. 4, lines 18-22].

Regarding claim 10, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of removing said protective layer comprises the step of removing said protective layer using a copper plating solution [see col. 4, lines 31-34].

Regarding claim 12, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of depositing a barrier layer comprises the step of forming a barrier layer by a process selected from the group comprising CVD, ALD or PVD [see col. 3, lines 41-52].

Regarding claims 13 and 14, **Dubin et al** disclose the method of claim 1, furthermore wherein the step of depositing a barrier layer and the step of forming a protective layer are performed in the same processing apparatus, and more specifically within the same processing chamber of a processing apparatus [see col. 5, lines 37-43].

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubin et al** (USPN 7,060,617) in view of **Kumagai et al** (USPN 7,081,370). **Dubin et al** disclose the method of claim 1 as described above. **Dubin et al** do not disclose wherein the protective layer disclosed therein is removed by etching. **Kumagai et al** teach a method of forming a protective film 7 over a surface which is later removed by etching, specifically using a mixture of sulfuric acid and hydrogen peroxide [see col. 9, lines 39-43]. It would have been obvious to one of ordinary skill in the art at the time of invention to optimize the process, including using the acidic etchant taught by **Kumagai et al** in the method taught by **Dubin et al** because it is well known in the art that the process of removal of a layer is determined by a number of variables, including etch chemistry.

Allowable Subject Matter

8. Claims 28 and 55-62 are allowed. The following is an examiner's statement of reasons for allowance: regarding claim 55, the prior art of record fails to teach or make reasonably obvious wherein an initial cathode current pulse is applied to a surface of a barrier layer; and regarding claim 59, the prior art of record fails to teach or make reasonably obvious a protective layer formed by exposing a surface to a sulfur- or phosphorus-containing gas.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

9. Applicant's arguments with respect to claims 1, 55 and 59 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion


10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. **Schacham-Diamand et al** (USPN 5,824,599).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-8603. The examiner can normally be reached on Monday through Friday, 9:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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